2018-2019 CAPITAL BUDGET REQUEST

REPAIRS TO DAMAGED GRANITE ARCH STRUCTURES IN WESTMORELAND AND WALPOLE

On the NH DOT owned
Cheshire Branch railroad corridor

Prepared By:

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REPAIRS TO DAMAGED GRANITE ARCH STRUCTURES IN WESTMORELAND AND WALPOLE

The Department of Transportation is requesting Capital Budget funds to repair two large damaged granite arch culverts on the Cheshire Branch Railroad Corridor that are major drainage conveyances under high embankments. The Department has had to cleanup and make temporary repairs to three granite arch culverts in Walpole and Westmoreland at a cost of over $700,000 in the last 10 years.

The Department is responsible for maintaining these two State owned granite arches, located in Westmoreland and Walpole, because they are major drainage structures under the railroad corridor. The Department has no funds available in their current budget to complete the repairs required to stabilize these granite arch structures against further collapse. The Department requested funding for these repairs over the last two budget cycles, but they were not approved. The Department is making a special request for these funds at this time so repairs can be made in the next year while the costs are relatively low compared to the cost of major reconstruction or replacement in the future if more damage occurs during storm events. The Department is also concerned about the potential for downstream flooding and damage if either of these arches collapses.

PROJECT OVERVIEW

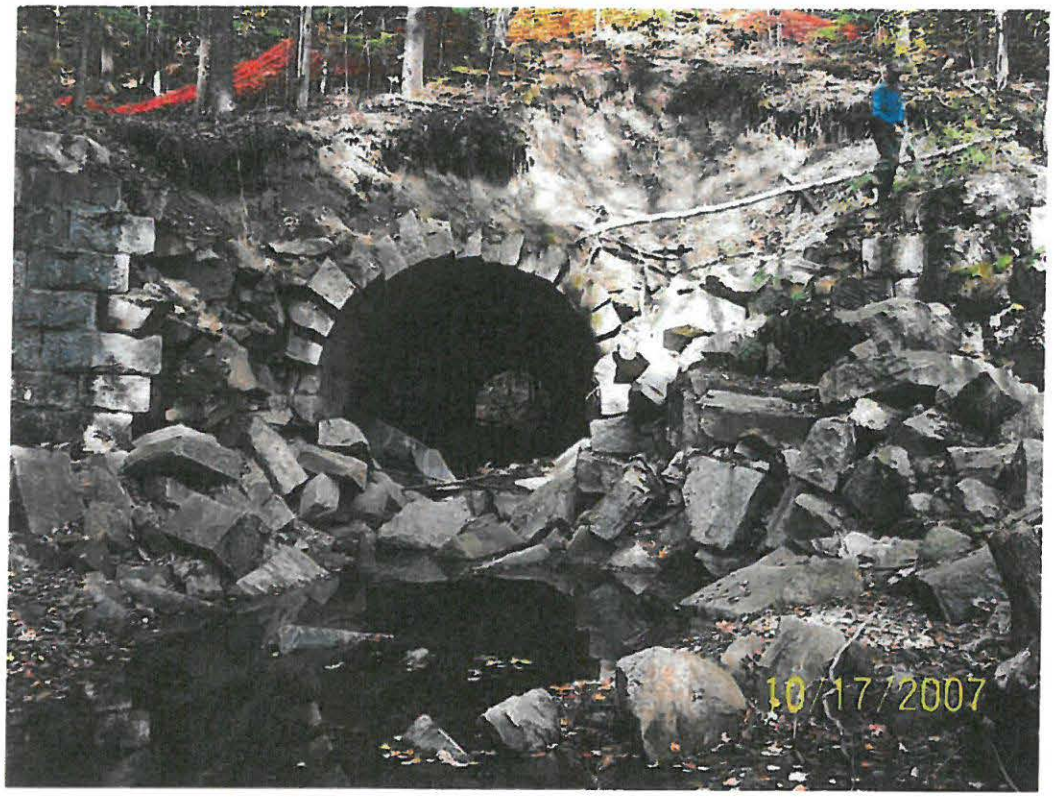
The Department is requesting funding to repair these two granite arches because the Department considers them to be in unstable condition and potential hazards to downstream properties during severe storm events as have occurred in the past.

The critical part of granite arches are the foundation blocks that support the arch. At these two arches the foundation blocks are already partially undermined and susceptible to further erosion. If these blocks become totally undermined by water flow and become loose or fall out, then the blocks above become unstable and begin to move and eventually fall out causing that portion of the arch to collapse.

A partial or complete collapse of an arch during a storm event creates a serious situation because it can create a blockage in the arch causing water to backup and impound on the upstream side of the 30-40 foot high embankment. The railroad embankments were not built to be a dam or to impound water and are susceptible to seepage and collapse due to water flow through the embankments. If the water does build to the top of the embankment and begins flowing over the top, then it will begin to erode the embankment causing large amounts of material and water to flood downstream causing significant property damage and possibly loss of life.

WESTMORELAND GRANITE ARCH B100.06

Westmoreland Granite Arch B100.06 partially collapsed in 2003, 2007, 2010, 2011 and 2013. The Department removed the debris from the brook that fell in during the collapses, installed a concrete floor in the arch in 2008 and performed temporary work to stabilize the outlet end of the arch over the last 10 years. These interim measures were done to stabilize the arch and in anticipation of future funding to construct a new outlet header at the arch to keep it from collapsing during heavy rain falls. To date that funding has not been provided. The following are photos of the 2007 arch collapse, additional damage in subsequent storms, photos of the flooding downstream at the Route 12 road bridge in 2013 and current photos of the unstable arch.



View of 2007 Arch Collapse

View of 2011 Arch Collapse

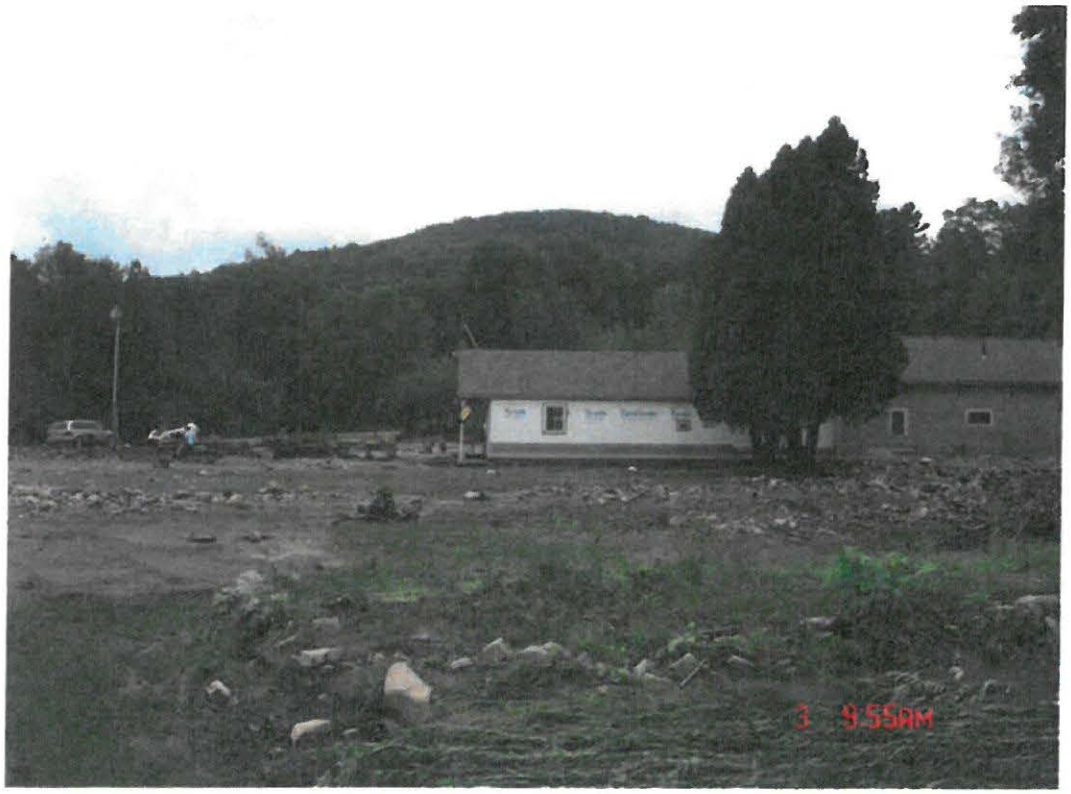
WESTMORELAND GRANITE ARCH B100.06

View of Arch Damage from July 2013 Storm

Close-up View of Arch Damage from July 2013 Storm

WESTMORELAND GRANITE ARCH B100.06

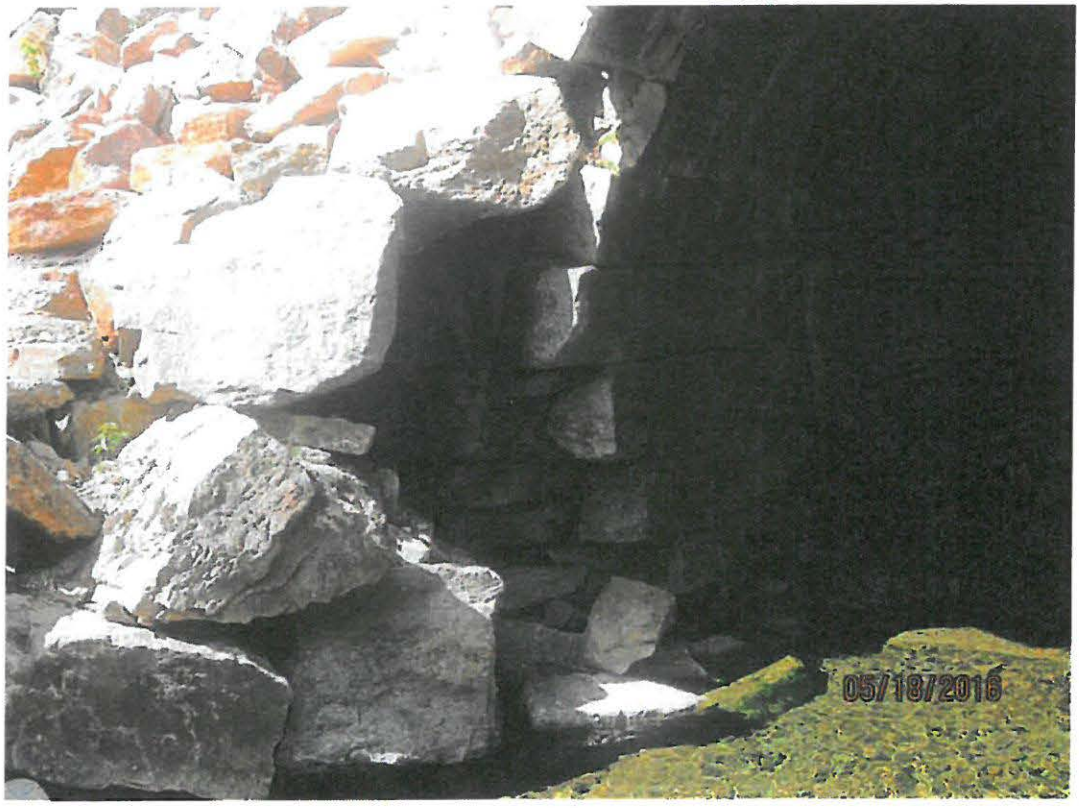
View of Downstream Flood Damage at Route 12 from July 2013 Storm



View of Downstream Flood Damage at Route 12 from July 2013 Storm

WESTMORELAND GRANITE ARCH B100.06

View of Undermined Right Side of Arch



View of Undermined Left Side of Arch

WESTMORELAND GRANITE ARCH B100.06

After the collapse in 2007, the Department installed a concrete floor in 90% of the arch in 2008 to keep the inlet end of the arch from becoming undermined. The floor could not be installed at the outlet end because the arch was considered too unstable to have workers in that portion of the arch.

After the collapse in 2013, the Department, NH DES, NH Emergency Management and other State and Federal agencies evaluated this granite arch and looked at all of the options for resolving the arch collapse problem; repair the outlet end, remove the arch entirely, add another culvert beside the arch, put in a bridge over the brook or lower the embankment to create a spillway. It was determined that the lowest cost effective solution and best engineering remedy for the downstream drainage issues and concerns was to maintain the granite arch in place and to construct a concrete header on the remaining portion of the outlet end and complete restoration of the site. The Department has completed some of the lower cost work to stabilize conditions at the site as events have occurred. The work that remains now for which the Department is seeking funding, is the construction of the outlet header to prevent future problems and damage.

The majority of the requested funds will be used to construct a new headwall on the outlet end of the Westmoreland granite arch to permanently stabilize the arch. The remaining funds will be used for engineering, plan preparation, DES permits, constructing rip rap outlet side slopes and completing the permanent restoration of the embankment slopes over the arch.

The following is a breakdown of the cost estimate for the work included in this funding request to complete repairs to the Westmoreland granite arch.

WESTMORELAND ARCH REPAIR COST SUMMARY

Engineering, design and permitting	$ 60,000
Brook diversion and pollution control	$ 20,000
Construct concrete outlet header	$ 275,000
Construction of rip rap outlet slopes	$ 15,000
Embankment grading and restoration	$ 20,000
Embankment ground cover restoration	$ 10,000
TOTAL	$ 400,000

WALPOLE GRANITE ARCH B106.65

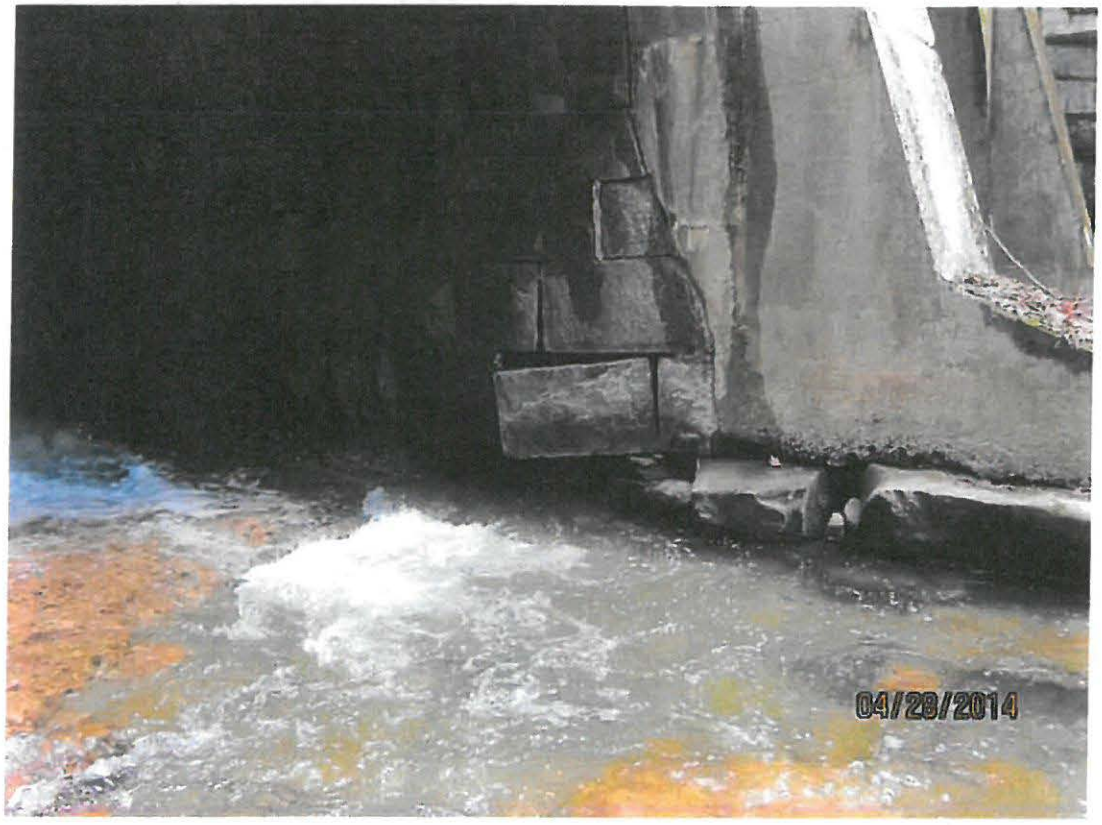
Walpole Granite Arch B106.65 is a twin arch that has deteriorated at the outlet end and inside a portion of the north arch. The previous railroad owner made substantial repairs to the outlet end of the arch during the time they owned the corridor. In the 2012 inspection of the arch, the Department found that the granite block spillway wall at the outlet end had many loose blocks and some were already missing. Funds were requested at that time for repairs, but none were provided.

In 2014 during a reinspection of the arch following the 2013 flooding in the area, the Department found that several additional granite blocks had become dislodged at the outlet and some had been washed away. In addition, several of the blocks in the north arch were undermined and beginning to fall out. The loss of these foundation blocks inside the arch and at the spillway wall have destabilized the arch structure and may eventually cause a partial collapse similar to what happened at the Westmoreland granite arch if not remedied. In 2015, the Department performed a temporary repair to reset some granite blocks and construct a partial concrete toe wall in the north arch to stabilize the arch's foundation blocks. No repairs were made to the spillway blocks due to the lack of funding. The work inside the arch was a temporary repair until funding could be obtained to reestablish the concrete floor in the north arch, construct a new outlet spillway wall, and to repair the other arch structure issues so the arch would be in a permanent stable condition. To date that funding has not been provided.

The following are photos that were taken in 2012, 2014 and 2016 showing the arch issues and the temporary repair inside the arch, the current condition of the arch and issues remaining to be completed to stabilize the arch structure.

Current View of Arch Showing Deterioration at Outlet End

WALPOLE GRANITE ARCH B106.65



View of Undermined Granite Blocks in 2014

View of Reset Granite Blocks and Concrete Completed in 2015

WALPOLE GRANITE ARCH B106.65

View of South Side of Outlet Spillway Wall Showing Deterioration

View of Missing Floor Slabs inside the North Arch

WALPOLE GRANITE ARCH B106.65

The Department has completed some emergency temporary repairs at this arch over the last 3 years at a cost of $20,000 in an effort to prevent possible collapse of the arch. The Department has been unable to complete long term stabilization required at this arch due to lack of funding.

The majority of the requested funds will be used to construct a concrete floor at the end of the north arch and a new concrete spillway wall at the outlet end of both arches. The work is required to prevent future damage and possible collapse of the arch, the cleanup cost of which could exceed $700,000. The remaining funds will be used for engineering, plan preparation, NH DES permits, constructing site access and constructing rip rap outlet protection. The Department has made emergency repairs in the past, but major repairs still remain to be made at this arch to ensure that the arch is stabilized and not in danger of future deterioration and possible collapse during a severe storm event.

The following is a breakdown of the costs for the work included in this funding request to repair the Walpole granite arch.

WALPOLE ARCH REPAIR COST SUMMARY

Engineering, design and permitting	$ 10,000
Brook diversion and pollution control	$ 10,000
Construct concrete floor slab	$ 15,000
Construct concrete spillway wall	$ 50,000
Place rip rap at outlet	$ 15,000
TOTAL	$ 100,000